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America, for although it includes only the forms of a single state, the peculiarly wide distribution of species of lichens makes the bulletin really a manual for the determination of the lichens of the whole country. The bulk of the bulletin consists of the catalogue of species, but it is much more than that, for the species are described with a fullness and an exactness unusual in such descriptions, and convenient keys make the approach to genera and species seem simple enough. The numerous admirable reproductions of photographs also bring clearly to the student the field aspect of the different forms.

There are 68 genera presented, comprising 314 species, and under the species there are often numerous varieties. It is of interest to note that the genera are not large, only 6 of them comprising 10 or more species, and the 2 largest (*Lecidea* and *Cladonia*) comprising only 29 species each. This means that the remaining genera are represented on the average by about 3 species. This is a striking illustration either of the constancy of lichen species over wide areas, or of the caution of lichenologists in recognizing variations as species. This is perhaps further emphasized by the fact that in the present publication not a single new species is proposed.

The catalogue is preceded by a general account of lichens, so that the student of classification may obtain adequate information as to the morphology of the group. There are also some interesting paragraphs dealing with the economic rôle of lichens, under the following heads: "as purifiers of the air," "as aids in rock disintegration," "as food," "as medicinal agents," "as dyestuffs," and "as related to the welfare of trees."

This book should prove a great stimulus to the study of lichens, a group which deserves to be more cultivated by American botanists.—J. M. C.

MINOR NOTICES

Plant-breeding in the United States.—Professors v. RÜMKER and v. TSCHERMAK have published a report[3] of their extended American visit during the spring and summer of 1909. The writers inspected most of the institutions in which either theoretical studies in genetics, or practical experiments in plant and animal breeding are in progress, as well as the work of numerous private breeders. The whole report forms an exceedingly keen and accurate review of the present operations along these lines in America. The material has been well sifted, analyzed, and systematically arranged. The chapters close with full bibliographies. In the first part, which is occupied with American studies in genetic theory, full reviews are given of the newer work of SHULL, CASTLE, TOWER, MORGAN, MACDOUGAL, and others. Part II, dealing with practical breeding operations, begins with an extended discussion of American experiment station investigations in corn breeding. The long-continued experiments at the Illinois station on the improvement of certain economic characters in corn by continuous selection, are given careful consideration, as also the theoretically more important work of SHULL and EAST. Full accounts of the experiments in breeding other cereals and various fodder plants under way at several experiment stations follow. The writers furnish what is perhaps the best brief general critique of LUTHER BURBANK and his much be-written work that has yet appeared, and which affords a refreshing change from the usual reiterated adoration of the stoneless prune, the plumcot, and the spineless cactus, to which our ears have so long been accustomed. What is still more interesting is the very appreciative and much deserved commentary on the valuable work of HANSEN in the amelioration of the wild fruits of the northwest plains region. The authors have been at pains to grasp thoroughly and put down minutely the rather complex morphology of our national Department of Agriculture and its protean subdivisions, accompanied by an astonishing genealogical tree of its ramifying functions and personnel that is worth that department's while to reproduce in English. The independent agricultural colleges visited were those of Kansas, South Dakota, and New Jersey, and those with university affiliations were Cornell, Wisconsin, Illinois, Minnesota, Nebraska, California, and Arizona, the organization and equipment being noted in each case. Agronomic methods, soil culture, and agricultural ecomomics in general are reviewed so far as the writers had time and opportunity to observe. Full and detailed accounts occur of the apparatus in use at the various experiment stations and botanical institutes visited. The authors display throughout a well balanced judicial temper in comparing American and European conditions as regards agricultural education and experimental work. The *Pracht* and *Glanz* of some of our munificently endowed American scientific and educational institutions do not conceal from the acute vision of the authors of this *Bericht* the humiliating circumstances that too often afflict the occupants of their chairs. Meager salaries, incessant teaching, papers and publications issued under forced draft, and the precious requirements of our American red-tape technique, which call for the perpetual pumping out of reports of scientific progress up to Saturday night, all of this has not escaped the European commentators' attention. "Dabei ist es jedoch noch immer als ein schwerer Fehler zu bezeichnen, dass die amerikanischen Mäzene zwar der Wissenschaft mit Recht herrliche Paläste bauen, die Diener der Wissenschaft jedoch—die Professoren und Dozenten—regelmässig vergessen" (p. 150).—H. F. ROBERTS.

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[3] RÜMKER, v., and TSCHERMAK, v., Landwirtschaftliche Studien in Nord-Amerika, mit besonderer Berücksichtigung der Pflanzenzüchtung. pp. 150. Berlin: Paul Parey. 1910.

Experiments in plant physiology.—HEALD and LEWIS have published[4] a set of experiments in plant physiology, designed to form the basis for a year of university work. The experiments are grouped under four heads arranged in the following order: growth (exps. 1–15), movement of water and gases (exps. 16–61), nutrition (exps. 62–115), and irritability (exps. 116–150). The

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[4] HEALD, F. DEF., and LEWIS, I. M., Experiments in plant physiology. pp. 70. *figs. 24.* Austin, Texas: the authors. 1910.